



## Operating Instructions

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## 1. Safety Regulations



For proper and safe operation, the measuring device must be installed, operated, and serviced according to NEC, local regulations, and these instructions. Otherwise, personal injuries or damage or both can occur.

Only qualified persons should work on these devices.

1. Use within the conditions specified in the *Swagelok General Industrial Transducer* catalog.
2. Always disconnect the device from its power supply before opening it. Do not touch any of the device's contacts after installing.
3. The shield / ground connection must be wired to ground to protect the instrument from electromagnetic disturbances.
4. If the device is visibly damaged or has been stored under inappropriate conditions, turn off the device and do not use again.

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## 2. Introduction

The Swagelok® PTI-PM remote panel mount display is a microprocessor-controlled device that supports one universal interface for the connection of standard transducer signals (0 to 20 mA, 4 to 20 mA, 0 to 50 mV, 0 to 1 V, and 0 to 10 V) and frequency (TTL and switching contact).

The device features two switching outputs, which can be configured as 2-point controller, 3-point controller, 2-point controller with min-/ max-alarm or common / individual min-/ max-alarm.

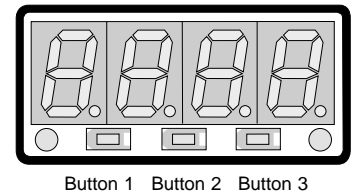
### 2.1 Accessing the programming buttons

Before the PTI-PM can be used, it has to be configured for the application.

The device has three buttons that will be used during the configuration process.

- Left button (Button 1) is used to confirm your entry
- Center button (Button 2) is used to increase a value
- Right button (Button 3) is used to decrease a value

*Note: Buttons 2 and 3 will increase or decrease in value by one each time the button is touched. If the button is held down, the value will increase or decrease quickly.*



There are two indicator lights to the far left and right of the three buttons.

- Left indicator light displays the status of the first output
- Right indicator light displays the status of the second output

*Note: In order to avoid undefined input states and unwanted or wrong processes, we suggest connecting the device's switching outputs after the device has been configured properly.*



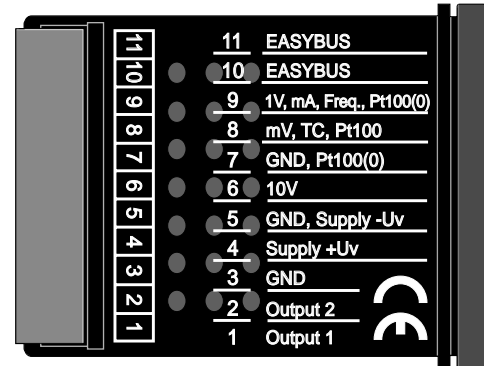
#### To configure the PTI-PM, follow these steps:

1. Connect device to power supply.
2. Remove red front panel to access programming buttons.
3. Turn on power supply. The device will run its built-in test.
4. Enter the required input signals. (See section 4.)
5. Enter the required output signals. (See section 4.)
6. Turn off power supply.
7. Replace red front panel.
8. Connect device to electrical connection. (See section 3.)

### 3. Electrical connection

#### 3.1. Terminal assignment

11	EASYBUS-Interface
10	EASYBUS-Interface
9	Input: 0 to 1 V, 0 to 2 V, mA, frequency, Pt100 Pt1000
8	Input: 0 to 50 mV, thermocouples, Pt100
7	Input: GND, Pt100, Pt1000
6	Input: 0 to 10 V
5	Supply voltage: GND
4	Supply voltage: +Uv
3	Switching output: GND
2	Switching output: 2
1	Switching output: 1



Note: The contacts 3, 5, and 7 are connected internally.

#### 3.2. Connection data

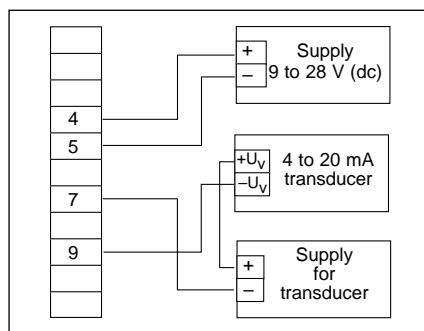
		Between Terminals	Typical		Limitations		Notes
			Min	Max	Min	Max	
Supply voltage		4 and 5	9 V	28 V	0 V	30 V	—
Switching output 1 and 2	NPN	1 and 3, 2 and 3	—	—	—	30 V, I < 1A	Not short circuit protected
	PNP		—	—	—	I < 200 mA	
Input mA		9 and 7	0 mA	20 mA	0 mA	30 mA	—
Input 0 to 1(2) V, Freq, ...			0 V	3.3 V	−1 V	4 V, I < 10 mA	—
Input 0 to 50 mV, TC, ...		8 and 7	0 V	3.3 V	−1 V	10 V, I < 10 mA	—
Input 0 to 10 V		6 and 7	0 V	10 V	−1 V	20 V	—

**Do not exceed the limit of the current and voltage.**

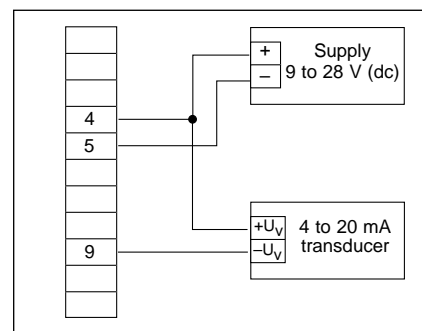
#### 3.3. Connecting an input signal

**Do not exceed the limits of the input when connecting the device.**

##### 3.3.1. Connecting a 4 to 20 mA transducer in 3-wire technology

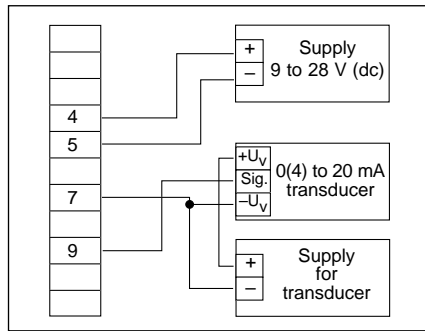


with individual transducer supply

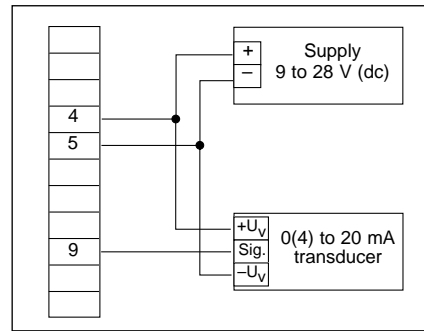


without individual transducer supply

### 3.3.2. Connecting a 0(4) to 20 mA transducer in 3-wire technology

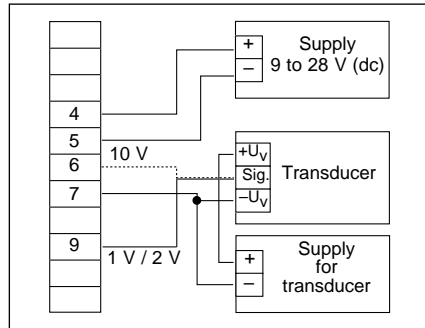


*with individual transducer supply*

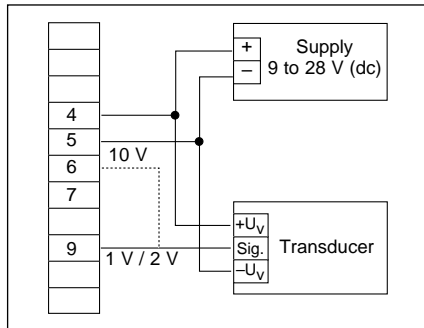


*without individual transducer supply*

### 3.3.3. Connecting a 0 to 1, 0 to 2 V, or 0 to 10 V transducer in 3-wire technology

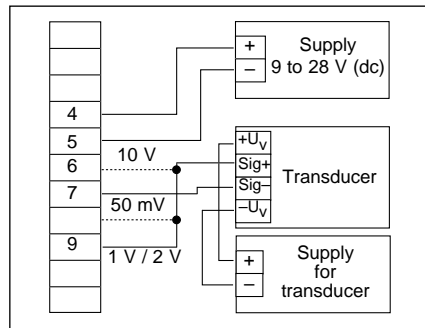


*with individual transducer supply*

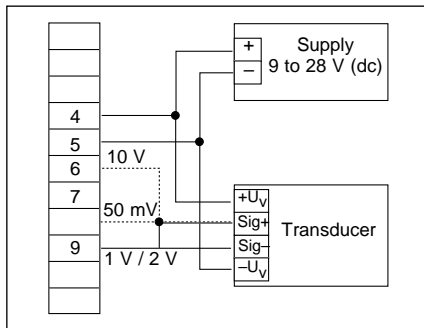


*without individual transducer supply*

### 3.3.4. Connecting a 0 to 1/2 / 10 V or 0 to 50 V transducer in 4-wire technology



*with individual transducer supply*



*without individual transducer supply*

### 3.4. Connecting switching outputs

The device features two switching outputs. There are three different operating modes for each switching output. The operating modes are:

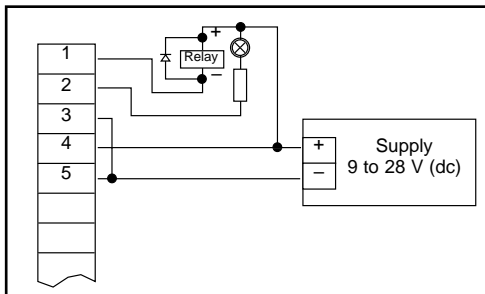
- Low-Side: “GND-switching” NPN output (open-collector)  
The switching output is connected to the negative rail of the supply voltage (connection 3 or 5) when active (switching output on).
- High-Side: “+Ub-switching” PNP output (open-collector)  
The switching output is connected to the positive rail of the supply voltage (connection 4) when active (switching output on).
- Push-Pull: The switching output is connected to the negative rail of the supply voltage (connection 3 or 5) when inactive. When the switching output is active, it is connected to the positive rail of the supply voltage (connection 4).

If one output is an alarm output, the output will be active in idle state (no alarm present). The output transistor opens or the push-pull output changes from +U<sub>v</sub> to –U<sub>v</sub> when an alarm condition occurs.

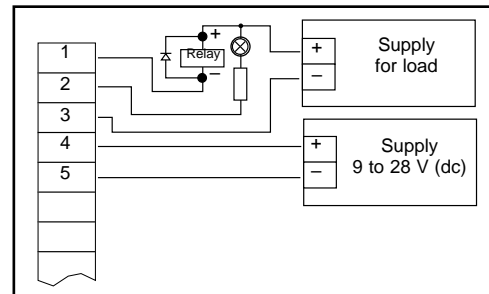
*Note: In order to avoid unwanted or wrong switching processes, connect the device's switching outputs after you have configured the device's switching outputs properly.*

**Do not not exceed the limits of the voltage and switching outputs.**

#### 3.4.1. Connection with configured low-side switching output (NPN output, switching to GND)



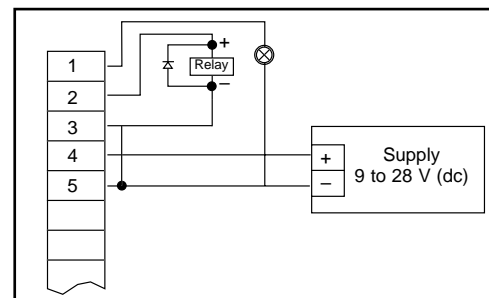
Connecting consumer loads (relay and lamp)  
(without individual supply voltage)



Connecting consumer loads (relay and lamp)  
(with individual supply voltage)

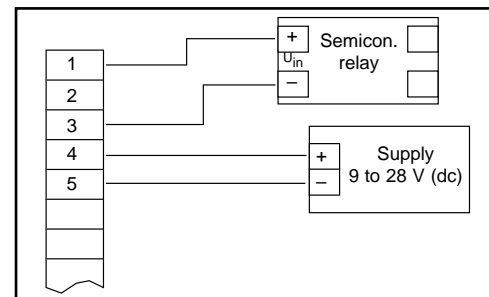
#### 3.4.2. Connection with configured high-side switching output (PNP output, switching to +U<sub>v</sub>)

*Note:*  
Connections 3 and 5 are electrically connected internally. When switching higher currents (greater than 50 mA), the –U<sub>v</sub> connection should not be attached to the device (connection 3) but to the –U<sub>v</sub> connection of the external voltage supply to eliminate ground displacement.



Connecting consumer loads (relay and lamp)

#### 3.4.3. Connection with configured push-pull switching output



Connecting a semiconductor-relay

### 3.5. Wiring of multiple PTI-PM digital indicators

Inputs and outputs are not electrically isolated. When interconnecting several PTI-PM, make sure there is no potential displacement.

Make sure to observe the following point:

- When several PTI-PMs are connected to the same power supply unit, electrically isolate the transducers.

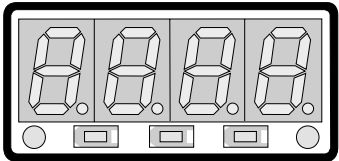
## 4. Configuring the Device

*Note:* If you do not press any button for more than 60 seconds, the configuration of the device will stop. The changes you have made will not be saved.

*Note:* Buttons 2 and 3 feature a “roll-function.” Pressing button 2 once raises the value by one; pressing button 3 once lowers the value by one. Pressing the button for longer than 1 second increases the counting speed. The device also features an “overflow-function;” when reaching the upper limit of the range, the device switches to the lower limit, and vice versa.

### 4.1. Selecting an input signal type

- Turn the device on and wait until it completes its built-in segment test.
- Press button 2 for longer than 2 seconds. The device displays “InP” (‘INPUT’).
- Use button 2 or button 3 to select the input signal (see table below).
- Confirm the selection with button 1. The display will show “InP” again.



Depending on the selected input signal, additional configurations will be needed.

Input type	Signal	To select as Input	See Section
Voltage signal	0 to 10 V	U	4.2
	0 to 2 V		
	0 to 1 V		
	0 to 50 mV		
Current signal	4 to 20 mA	I	4.2
	0 to 20 mA		

*Note:* When changing the measuring mode “InP,” the input signal “SEnS,” and the measuring unit “Unit,” all settings will be changed to factory default. You have to set all the other settings, including the settings for zero and span adjustment and switching points.



## 4.2. Measuring voltage and current (0 to 50 mV, 0 to 1 V, 0 to 2 V, 0 to 10 V, 0 to 20 mA, 4 to 20 mA)

This section describes how to configure the PTI-PM for measuring voltage or current signals from an external transducer. You must select “U” or “I” as your desired input type, as explained in Section 4.1. The display has to show “InP.”

- Press Button 1. The display shows “SEnS.”
- Select the desired input signal using button 2 or button 3.

Display	Input Signal (Voltage Measuring)
10.00	0 to 10 V
2.00	0 to 2 V
1.00	0 to 1 V
0.050	0 to 50 mV

Display	Input Signal (Current Measuring)
4 to 20	4 to 20 mA
0-20	0 to 20 mA

- Confirm the selected input signal by pressing button 1. The display shows “SEnS” again.
- Press button 1 again. The display will show “dP” (decimal point).
- Select the desired decimal point place by pressing button 2 or button 3.
- Confirm the selected decimal point by pressing button 1. The display shows “dP” again.
- Press button 1 again. The display will show “di.Lo” (Display Low = low display value).
- Use button 2 or button 3 to select the desired value the device should display when a 0 mA, 4 mA, or 0 V input signal is attached.
- Confirm the selected value by pressing button 1. The display shows “di.Lo” again.
- Press button 1 again. The display will show “di.Hi” (Display High = high display value).
- Use button 2 or button 3 to select the desired value the device should display when a 20 mA, 50 mV, 1 V, 2 V, or 10 V input signal is attached.
- Confirm the selected value by pressing button 1. The display shows “di.Hi” again.
- Press button 1 again. The display will show “Li” (Limit = measuring range limit).
- Use button 2 or button 3 to select the desired measuring range limit.

Display	Measuring Input Limit	Note
Off	Deactivated	Exceeding the measuring range limit is tolerable for about 10 % of the selected input signal.
On.er	Active (displays error)	The measuring range limit is bound by the input signal. When outside the input signal, the device will display an error message.
On.rg	Active (displays the selected limit)	The measuring range limit is bound by the input signal. When outside the input signal, the device will display the selected lower / upper display value.

*Note: When exceeding the measuring range limit greater than 10 % independently from the setting, the device will always display an error message (“Err.1” or “Err.2”).*

- Press button 1 to confirm the selection. The display shows “Li” again.

- When pressing button 1 again, the display will show “**FiLt**” (Filter = digital filter).
- Use button 2 or button 3 to select the desired filter [in sec.]. Selectable values: 0.01 to 2.00 seconds.

*Note: When using the input signal 0 to 50 mV, a filter value of at least 0.2 is recommended.*

*Explanation: This digital filter is a digital replica of a low-pass filter.*

- Press button 1 to confirm your value. The display shows “**FiLt**” again.

Now your device is adjusted to your signal source. To adjust the outputs of the device:

- Press button 1 again. The display shows “**outP**” (output).  
To configure the outputs of the PTI-PM, please follow the instructions in Section 4.3.

### 4.3. Selecting the output function

- After configuring the input (Section 4.2), you have to select the output function.  
The display shows “**outP**” (output).
- Use button 2 or button 3 to select the desired output function.

Description	Function		To select as Output	See Section
	Output 1	Output 2		
No output; device is used as display unit	—	—		—
2-point-controller	digital 2-point controller	—		5.1
3-point-controller	digital 2-point controller	digital 2-point controller	3P	5.1
2-point controller with Min/Max alarm	digital 2-point controller	Min/Max alarm	2P.AL	5.2
Min/Max alarm, common	—	Min/Max alarm	AL.F1	5.3
Min/Max alarm, individual	Max alarm	Min alarm	AL.F2	5.3

- Press button 1 to confirm the selected output function. The display shows “**outP**” again.

*Depending on your output function setting, it is possible that one or more settings described below will not be available.*

- When pressing button 1 again, the device will be displaying “**1.dEL**” (delay of output 1).
- Use button 2 and button 3 to set the desired value [in sec.] for the switching delay of output 1.
- Press button 1 to confirm the selection. The display shows “**1.dEL**” again.
- When pressing button 1 again, the device will be displaying “**1.out**” (kind of output 1).
- Use button 2 and button 3 to select the desired output function.

Display	Kind of Output
nPn	Low-Side NPN, open collector, switching GND
PnP	High-Side PNP, open collector, switching +Ub
Pu.Pu	Push-Pull

- Press button 1 to confirm the selection. The display shows “**1.out**” again.
- When pressing button 1 again, the device will display “**1.Err**” (preferred state of output 1).
- Use button 2 or button 3 to set the desired initial state in case of an error.

Display	Kind of Output	Note
Off	Inactive in case of an error	Low- / High-side switch is opened in case of an error. Push-Pull output is low in case of an error.
On	Active in case of an error	Low- / High-side switch is closed in case of an error. Push-Pull-output is high in case of an error.

- Press button 1 to confirm the selection. The display shows “**1.Err**” again.
- If you selected a 3-point controller, the level 2 settings must be the same as level 1 settings.  
“**2.dEL**” (delay of output 2), “**2.out**” (kind of output 2), “**2.Err**” (preferred state of output 2).
- When pressing button 1 again, (only if you configured the device with min/max alarm), the device will display “**A.out**” (type of alarm output).
- Use button 2 or button 3 to select the type of alarm output.

Display	Kind of Alarm Output	Note
nPn	Low-Side NPN, open collector, switching GND	Switching output is closed (connected to GND) as long there is no alarm condition and is opened if there is an alarm condition.
PnP	High-Side PNP, open collector, switching +Ub	Switching output is closed (is under voltage) as long there is no alarm condition and is opened if there is an alarm condition.
Pu.Pu	Push-Pull	Switching output is high with no alarm condition and changes to low if there is an alarm condition.

**Note:** *The switching outputs are inverted when used as alarm outputs. This means as long there is no alarm condition, the switching output will be active. In case of an alarm condition, the output will become inactive.*

**Note:** *When using the output function “min / max alarm, individual” the setting for type of alarm output is used for both alarm outputs.*

- Press button 1 to confirm the selection. The display shows “**A.out**” again.

Depending on the selected output function, you have to make the settings for switching or alarm points. See description in section “switch points and alarm boundaries” for further information.

**Note:** *The settings for the switching and alarm points can be made later in an extra menu (see Section 5).*

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## 5. Switch points and alarm boundaries

- Pressing button 1 for longer than 2 seconds will bring up the menu to select the switch points and alarm boundaries.
- Depending on the configuration you have made in the “output” menu, you will get different display values. Please see the specific section for further information.

Description	Function		To select as Output	See Section
	Output 1	Output 2		
No output; device is used as display unit	—	—		No function call possible
2-point-controller	digital 2-point-controller	—		5.1
3-point-controller	digital 2-point-controller	digital 2-point-controller	3P	5.1
2-point-controller with Min-/Max-alarm	digital 2-point-controller	Min-/Max-alarm	2P.AL	5.2
Min-/Max-alarm, common	—	Min-/Max-alarm	AL.F1	5.3
Min-/Max-alarm, individual	Min-alarm	Min-alarm	AL.F2	5.3

### 5.1. 2-point controller, 3-point controller

This section describes how to configure the device as a 2-point or 3-point controller. You must have already selected “2P” or “3P” as your desired output function.

- Press button 1. The device will display “1.on” (turn-on point of output 1).
- Use button 2 or button 3 to set the desired value. The device’s output 1 will turn *ON*.
- Press button 1 to confirm your selection. The display shows “1.on” again.
- When pressing button 1 again, the device will display “1.off” (turn-off point of output 1).
- Use button 2 or button 3 to set the desired value. The device’s output 1 will turn *OFF*.
- Press button 1 to confirm your selection. The display shows “1.on” again.

If you selected ‘2-point controller’, you are finished configuring your device. Press button 3 to switch over to display the measuring value.

If you selected ‘3-point controller,’ please follow the instructions below.

- Press button 1. The device will display “2.on” (turn-on point of output 2).
- Use button 2 or button 3 to set the desired value. The device’s output 2 will turn *ON*.
- Press button 1 to confirm your selection. The display shows “2.on” again.
- When pressing button 1 again, the device will be displaying “2.off” (turn-off point of output 2).
- Use button 2 or button 3 to set the desired value. The device’s output 2 will turn *OFF*.
- Press button 1 to confirm your selection. The display shows “2.on” again.

Now you have finished configuring your device. Press button 3 to switch over to display the measuring value.

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## 5.2. 2-point controller with alarm function

This section describes how to configure the device as a 2-point controller with alarm function. You must select **"2P.AL"** as your desired output function.

- Press button 1. The device will display **"1.on"** (turn-on point of output 1).
- Use button 2 or button 3 to set the desired value. The device's output 1 will turn *ON*.
- Press button 1 to confirm your selection. The display shows **"1.on"** again.
- When pressing button 1 again, the device will be displaying **"1.off"** (turn-off point of output 1).
- Use button 2 or button 3 to set the desired value. The device's output 1 will turn *OFF*.
- Press button 1 to confirm your selection. The display shows **"1.on"** again.
- When pressing button 1, the device will display **"AL.Hi"** (maximum alarm-value).
- Use button 2 or button 3 to set the desired value. The device will turn on its maximum alarm.
- Press button 1 to confirm your selection. The display shows **"AL.Hi"** again.
- When pressing button 1 again, the device will display **"AL.Lo"** (minimum alarm value).
- Use button 2 or button 3 to set the desired value. The device will turn on its minimum alarm.
- Press button 1 to confirm your selection. The display shows **"AL.Lo"** again.
- When pressing button 1 again, the device will display **"A.dEL"** (delay of the alarm function).
- Use button 2 or button 3 to set the desired delay of the alarm function.

*Note: The unit of the value will be in [sec.]. The device will turn on the alarm after the minimum or the maximum alarm value was active for the delay time you have set.*

- Press button 1 to confirm the delay time. The display shows **"A.dEL"** again.

Now you have finished configuring your device. Press button 3 to switch over to display the measuring value.

## 5.3. Minimum/maximum-alarm (individual or common)

This section describes how to configure the device's alarm boundaries for min / max alarm monitoring. You must have selected **"AL.F1"** or **"AL.F1"** as your desired output function.

- Press button 1. The device will display **"AL.Hi"** (maximum alarm value).
- Use button 2 or button 3 to set the desired value. The device will turn on its maximum alarm.
- Press button 1 to confirm your selection. The display shows **"AL.Hi"** again.
- When pressing button 1 again, the device will display **"AL.Lo"** (minimum alarm value).
- Use button 2 or button 3 to set the desired value. The device will turn on its minimum alarm.
- Press button 1 to confirm your selection. The display shows **"AL.Lo"** again.
- When pressing button 1 again, the device will display **"A.dEL"** (delay of the alarm function).
- Use button 2 or button 3 to set the desired delay of the alarm function.

*Note: The unit of the value to be set is in seconds. The device will turn on the alarm after minimum or maximum alarm value was active for the delay time you have set.*

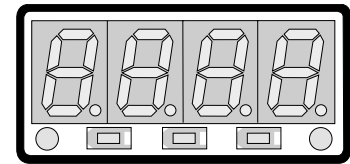
- Press button 1 to confirm the delay time. The display shows **"A.dEL"** again.

Now you have finished configuring your device. Press button 3 to switch over to display the measuring value.

## 6. Zero and Span adjustment

The zero and span adjustment function can be used for compensating the tolerance of the transducer.

- Turn on the device, and wait until it finishes its built-in segment test.
- Press button 3 longer than 2 seconds. The device will display "OFFS" (offset).
- Use button 2 and button 3 for setting the desired offset value.  
The input of the offset will be in digit °C / °F. The value that had been set will be subtracted from the measured value. (See below for further information.)
- Press button 1 to confirm your selection. The display shows "OFFS" again.
- When pressing button 1 again, the device will be displaying "SCAL" (scale = span).
- Use button 2 and button 3 to select the desired span adjustment.



The span adjustment will be entered in %. The value displayed can be calculated like this:

$$\text{Displayed value} = (\text{measured value} - \text{zero point offset}) * (1 + \text{span adjustment } [\% / 100]).$$

*Example: The setting is 2.00 => the span has risen 2.00 % => slope = 102 %.  
When measuring a value of 1000 (without span adjustment), the device would display 1020 (with span adjustment of 102 %).*

- Press button 1 to confirm the selection of the span adjustment. The display shows "SCAL" again.

*Example: Connecting a 4 to 20 mA pressure transducer*

*The device displays the following values (without zero or span adjustment): 0.08 at 0.00 bar and 20.02 at 20.00 bar*

*Therefore you calculated:*

zero point:	0.08
span:	$20.02 - 0.08 = 19.94$
deviation:	$0.06 (= \text{target span} - \text{actual span} = 20.00 - 19.94)$

*You have to set:*

offset =	0.08 (= zero point deviation)
scale =	$0.30 (= \text{deviation} / \text{actual span} = 0.06 / 19.94 = 0.0030 = 0.30 \%)$

## 7. Min / max value storage

The device features a minimum/maximum value storage. In this storage, the highest and lowest performance data is saved.

How to . . .	Action	Details
Display the minimum value	Press button 3	The device will display "Lo" briefly. After that, the min value is displayed for about 2 seconds.
Display the maximum value	Press button 2	The device will display "Hi" briefly. After that, the max value is displayed for about 2 seconds.
Erase the min/max values	Press button 2 and 3 for 2 second displayed value	The device will display "CLr" briefly. After that, the min / max values are set to the current.

---

## 8. Error codes

### Err.1: Exceeding the measuring range

Indicates that the valid measuring range of the device has been exceeded.

Possible causes:

- Input signal too high.
- Sensor shorted (0(4) to 20 mA).

---

Remedies:

- The error-message will be reset if the input signal is within the limits.
- Check transducer.
- Reset the counter.

### Err.2: Values below the measuring range

Indicates that the values are below the valid measuring range of the device.

Possible causes:

- Input signal is too low or negative.
- Current below 4 mA.
- Sensor broken.
- Counter underflow.

---

Remedies:

- The error message will be reset if the input signal is within the limits.
- Check transducer.
- Reset the counter.

### Err.3: Display range has been exceeded

Indicates that the valid display range (9999 digit) of the device has been exceeded.

Possible causes:

- Incorrect scale.

---

Remedies:

- The error message will be reset if the display value is below 9999.
- Check the scale setting, and reduce if necessary.

### Err.4: Values below display range

Indicates that display value is below the valid display range of the device (–1999 digit).

Possible causes:

- Incorrect scale.

---

Remedies:

- The error message will be reset if the display value is above 1999.
- Check the scale setting, and increase if necessary.

### Err.7: System error

The device features an integrated self-diagnostic function which checks essential parts of the device. When detecting a failure, error message Err 7 will be displayed.

Possible causes:

- Operating outside of the valid temperature range.
- Device is defective.

---

Remedies:

- Stay within the valid temperature range.
- Exchange the defective device.

### Err.9: Sensor defective

The device features an integrated diagnostic function for the connected transducer. When detecting a failure, error message Err 9 will be displayed.

Possible causes:

- Sensor broken.

---

Remedies:

- Check sensor or exchange defective sensor.

### Er.11: Value could not be calculated

Indicates a measuring value needed to calculate the display value is out of range.

Possible causes:

- Incorrect scale.

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Remedies:

- Check settings and input signal.

